

SEARCH REQUEST FORM**Scientific and Technical Information Center**

Requester's Full Name: Patricia Hailey Examiner #: 69382 Date: 11-2-06
Art Unit: 1755 Phone Number 302-01369 Serial Number: 10/830,182
Mail Box and Bldg/Room Location: 9D18 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: _____

Inventors (please provide full names): _____

Earliest Priority Filing Date: _____

**For Sequence Searches Only* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.*

Please see attached.

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	Type of Search	Vendors and cost where applicable
Searcher: <u>EL</u>	NA Sequence (#) _____	STN <u>\$ 316.78</u>
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Date Completed: <u>11-3-06</u>	Litigation <u>2</u>	Lexis/Nexis _____
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Clerical Prep Time: _____	Patent Family _____	WWW/Internet _____
Online Time: <u>80</u>	Other _____	Other (specify) _____

In the Claims:

Claim 1 (currently amended) A electrocatalyst[✓] for oxygen reduction comprising a cobalt and ruthenium sulfide supported on an electrically conductive support carbon.

Cancel Claim 2.

Claim 3 (currently amended) The electrocatalyst of claim 2 1 wherein said conductive carbon is a carbon black having a surface area exceeding 120 g/m².

Claim 4 (cancelled).

Claim 5 (currently amended) The electrocatalyst of claim 1 obtained by incipient wetness impregnation of said support with an aqueous solution of precursor salts of cobalt and ruthenium, optionally comprising ruthenium chloride, drying the impregnated support and treating the resulting product under an atmosphere of hydrogen sulfide[✓] optionally diluted with an inert carrier gas.

Claim 6 (currently amended) The electrocatalyst of claim 3 obtained by aqueous precipitation of a cobalt and ruthenium oxide on said carbon, drying and treating the resulting product under an atmosphere of hydrogen sulfide optionally diluted with an inert carrier gas.

Claim 7 (currently amended) The electrocatalyst of claim 1 wherein said sulfide is a ternary sulfide of ruthenium and cobalt ~~a transition metal M~~.

Cancel Claims 8 and 9.

Claim 10 (currently amended) The electrocatalyst of claim 9 1 wherein the atomic ratio Ru:Co is comprised between 0.2 and 5.

Cancel Claim 11.

Claim 12 (currently amended) The electrocatalyst of claim 9 1 obtained by incipient wetness impregnation of carbon support with an aqueous solution of precursor salts of ruthenium and of cobalt, drying said impregnated carbon and treating the resulting product under an atmosphere of hydrogen sulfide optionally diluted with an inert carrier gas.

Claim 13 (currently amended) The electrocatalyst of claim 12 wherein said precursor salts comprise at least one of RuCl_3 and $\text{Co}(\text{NO}_3)_2$.

Claim 14 (currently amended) The electrocatalyst of claim ~~11~~ 12 wherein said aqueous solution of precursor salts comprises 2-propanol.

Claim 15 (currently amended) The electrocatalyst of claim ~~11~~ 12 wherein said drying step is carried out under vacuum at a temperature above 90°C.

Claim 16 (currently amended) The electrocatalyst of claim ~~11~~ 12 wherein said treatment under an atmosphere of hydrogen sulfide is carried out in a flow reactor.

Claim 17 (currently amended) The electrocatalyst of claim ~~11~~ 12 wherein said treatment under an atmosphere of hydrogen sulfide is carried out at a temperature exceeding 100°C.

Claim 18 (currently amended) The electrocatalyst of claim ~~11~~ 12 wherein said treatment under an atmosphere of hydrogen sulfide is protracted for a time exceeding thirty minutes.

Claim 19 (currently amended) The electrocatalyst of claim ~~11~~ 12 wherein said inert carrier gas is nitrogen and the molar ratio of said nitrogen sulfide is comprised between 0.5 and 4.

Claim 20 (previously presented) A gas diffusion electrode comprising a conductive web wherein the catalyst of claim 1 is applied on at least one face of said conductive web.

Claim 21 (previously presented) The gas diffusion electrode of claim 20 wherein said conductive web is a carbon cloth.

Claim 22 (previously presented) The gas diffusion electrode of claim 20 wherein said catalyst is mixed with an optionally perfluorinated hydrophobic binder.

Claims 23 to 35 (cancelled).

Claim 36 (previously presented) A method for producing a gas diffusion electrode of claim 20 comprising coating said conductive web on at least one side thereof with said catalyst optionally mixed with a first hydrophobic binder.

Claim 37 (previously presented) The method of claim 36 wherein said conductive web is a carbon cloth.

Claim 38 (previously presented) The method of claim 36 wherein said first hydrophobic binder is perfluorinated.

Claim 39 (currently amended) The method of claim 36 wherein said conductive web is coated with a mixture of carbon powder and a second optionally perfluorinated hydrophobic binder on at least one side thereof, prior to said coating with said catalyst.

Claim 40 (previously presented) The method of claim 36 further comprising a final sintering step.

Claim 41 (previously presented) The method of claim 40 wherein said final sintering step comprises heating under a hydrogen atmosphere from room temperature up to an intermediate temperature, and subsequently heating under an inert atmosphere from said intermediate temperature up to a final temperature.

Claim 42 (previously presented) The method of claim 41 wherein said intermediate temperature is between 100 and 120°C.

Claim 43 (previously presented) The method of claim 41 wherein said final temperature is between 300 and 350°C.

Claim 44 (previously presented) The method of claim 41 wherein said inert atmosphere is an argon atmosphere.

Claim 45 (previously presented) A process of hydrochloric acid depolarized electrolysis comprising assembling the gas diffusion electrode of claim 20 as the cathode of an electrolysis cell fed with a hydrochloric acid aqueous solution and supplying oxygen thereto while applying electrical current.

Claim 46 (currently amended)
atomic ratio is 2.8 to 3.2.

The electrocatalyst of claim 10 wherein the

Claim 47 (currently amended)
temperature is between 300 and 500°C.

The electrocatalyst of claim 17 wherein the

Claim 48 (currently amended)
time is 1 to 4 hours.

The electrocatalyst of claim 18 wherein the

ABSTRACT OF THE DISCLOSURE

Ruthenium sulfide catalyst and gas diffusion electrodes incorporating the same for reduction of oxygen in industrial electrolyzers which catalyst is highly resistant to corrosion making it useful for oxygen-depolarized aqueous hydrochloric acid electrolysis.



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Bib Data Sheet

CONFIRMATION NO. 7722

SERIAL NUMBER 10/830,182	FILING OR 371(c) DATE 04/22/2004 RULE	CLASS 502	GROUP ART UNIT 1755	ATTORNEY DOCKET NO. 426.008A
APPLICANTS Andrea F. Gulla, Malden, MA; Robert J. Allen, South Harwich, MA; Emory S. De Castro, Nahant, MA;				
** CONTINUING DATA ***** This appln claims benefit of 60/473,543 05/27/2003				
** FOREIGN APPLICATIONS *****				
IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 06/28/2004				
Foreign Priority claimed <input type="checkbox"/> yes <input type="checkbox"/> no 35 USC 119 (a-d) conditions <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> Met after met Allowance Verified and Acknowledged _____ Examiner's Signature Initials		STATE OR COUNTRY MA	SHEETS DRAWING 0	TOTAL CLAIMS 45
INDEPENDENT CLAIMS 3				
ADDRESS 47888				
TITLE Catalyst for oxygen reduction				
FILING FEE RECEIVED 1320	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		<input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue) <input type="checkbox"/> Other _____ <input type="checkbox"/> Credit	

Banks, Kendra

206474

From: PATRICIA HAILEY [lynn.hailey@uspto.gov]
Sent: Thursday, November 02, 2006 10:20 AM
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Subject: Database Search Request, Serial Number: 10/830,182

Requester:
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SCIENTIFIC REFERENCE BR
Sci & Tech Inf. Cntr

NOV 02 RECD

Pat. & T.M. Office

Case serial number:
10/830,182
Class / Subclass(es):
502/185, 182, 222, 223
Earliest Priority Filing Date:
05/27/2003
Format preferred for results:
Paper

Search Topic Information:

An electrocatalyst comprising mixed metal sulfide of cobalt and ruthenium supported by carbon. The electrocatalyst is prepared by (1) impregnation of the support with aqueous solutions of metal salt precursors (e.g., ruthenium chloride), or (2) by aqueous precipitation of cobalt and ruthenium oxide on carbon, each of (1) and (2) followed by drying and treating with hydrogen sulfide.

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FILE 'HCAPLUS' ENTERED AT 16:59:29 ON 03 NOV 2006

L1 107 S GULLA ?/AU
L2 30768 S ALLEN ?/AU
L3 274417 S DE CASTRO ?/AU OR DECASTRO ?/AU OR CASTRO ?/AU OR DE ?/
L4 2 S L1 AND L2 AND L3

FILE 'REGISTRY' ENTERED AT 17:03:20 ON 03 NOV 2006

E RUTHENIUM SULFIDE/CN
L5 1 S E3
L6 22 S (RU(L)S)/ELS (L) 2/ELC.SUB
E COBALT SULFIDE/CN
L7 2 S E3
L8 214 S (CO(L)S)/ELS (L) 2/ELC.SUB
E RUTHENIUM NITRATE/CN
L9 1 S E3
E RUTHENIUM CHLORIDE/CN
L10 2 S E3
E COBALT NITRATE/CN
L11 2 S E3
E COBALT CHLORIDE/CN
L12 2 S E3

FILE 'HCA' ENTERED AT 17:10:03 ON 03 NOV 2006

L13 1370312 S CAT# OR CATALY?
L14 487 S L5 OR L6
L15 2152 S L7 OR L8
L16 3346 S L9 OR L10
L17 14516 S L11 OR L12

FILE 'REGISTRY' ENTERED AT 17:11:42 ON 03 NOV 2006

L18 1 S 800376-77-6
L19 5 S (RU(L)CO(L)S)/ELS (L) 3/ELC.SUB

FILE 'HCA' ENTERED AT 17:13:23 ON 03 NOV 2006

L20 5 S L18 OR L19
L21 68 S L20 OR (L14 AND L15)
L22 3 S L21 AND L16
L23 1 S L21 AND L17
L24 1 S L22 AND L23

FILE 'REGISTRY' ENTERED AT 17:15:20 ON 03 NOV 2006

E HYDROGEN SULFIDE/CN

L25 1 S E3

E OXYGEN/CN

L26 1 S E3

FILE 'HCA' ENTERED AT 17:18:58 ON 03 NOV 2006

L27 101824 S L25 OR HYDROGEN#(W)SULFIDE# OR H2S

L28 612846 S L26 OR OXYGENA? OR O2 OR (OXYGEN# OR O) (2A) (ATM# OR ATM

L29 13 S L21 AND L27

L30 2 S L21 AND L28

FILE 'REGISTRY' ENTERED AT 17:20:15 ON 03 NOV 2006

L31 15161 S RU/ELS NOT C/ELS

L32 141522 S CO/ELS NOT C/ELS

L33 15136 S L31 NOT (L5 OR L6 OR L9 OR L10)

L34 141304 S L32 NOT (L7 OR L8 OR L11 OR L12)

FILE 'HCA' ENTERED AT 17:21:50 ON 03 NOV 2006

L35 64325 S L33

L36 345312 S L34

L37 18 S L21 AND L35

L38 26 S L21 AND L36

L39 10 S L37 AND L13

L40 12 S L38 AND L13

L41 15024 S ELECTROCAT?

L42 0 S L37 AND L41

L43 0 S L38 AND L41

L44 3 S L22 OR L23 OR L24 OR L30

L45 20 S (L29 OR L39 OR L40) NOT L44

L46 48 S L21 AND L13

L47 1 S L21 AND (L41 OR ELECTRO(2A) (CAT# OR CATALY?))

L48 4 S L44 OR L47

L49 20 S L45 NOT L48

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=> D L48 1-4 CBIB ABS HITSTR HITIND

L48 ANSWER 1 OF 4 HCA COPYRIGHT 2006 ACS on STN

142:28827 Catalyst for oxygen reduction. Gulla, Andrea F.; Allen, Robert J.; De Castro, Emory S. (USA). U.S. Pat. Appl. Publ. US 2004242412 A1 20041202, 6 pp. (English). CODEN: USXXCO. APPLICATION: US 2004-830182 20040422. PRIORITY: US 2003-PV473543 20030527.

AB Ruthenium sulfide catalyst and gas diffusion electrodes incorporating the same for redn. of oxygen in industrial electrolyzers which catalyst is highly resistant to corrosion making it useful for oxygen-depolarized aq. hydrochloric acid electrolysis.

IT **800376-77-6P**, Cobalt ruthenium sulfide
(catalyst for oxygen redn.)

RN 800376-77-6 HCA

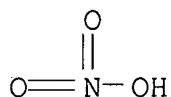
CN Cobalt ruthenium sulfide (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
S	x	7704-34-9
Co	x	7440-48-4
Ru	x	7440-18-8

IT **10141-05-6**, Cobalt nitrate
(precursor for prepn. of cobalt ruthenium sulfide catalyst for oxygen electroredn.)

RN 10141-05-6 HCA

CN Nitric acid, cobalt(2+) salt (8CI, 9CI) (CA INDEX NAME)

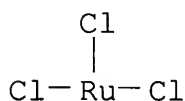


● 1/2 Co(II)

IT **10049-08-8**, Ruthenium trichloride
(precursor for prepn. of ruthenium sulfide catalyst for oxygen electroredn.)

RN 10049-08-8 HCA

CN Ruthenium chloride (RuCl₃) (6CI, 8CI, 9CI) (CA INDEX NAME)



IT **7782-44-7**, Oxygen, reactions

(ruthenium sulfide catalyst for redn. of)
RN 7782-44-7 HCA
CN Oxygen (8CI, 9CI) (CA INDEX NAME)

O=O

IC ICM B01J027-02
ICS B01J027-045; B01J021-18; B01J023-74; B01J023-40; H01M004-88;
G01N027-26

INCL 502216000; 502223000; 502185000; 502101000; 204432000

CC 67-1 (Catalysis, Reaction Kinetics, and Inorganic Reaction
Mechanisms)

Section cross-reference(s): 72, 78

IT 37245-92-4P, Ruthenium sulfide **800376-77-6P**, Cobalt
ruthenium sulfide

(catalyst for oxygen redn.)

IT **10141-05-6**, Cobalt nitrate

(precursor for prepn. of cobalt ruthenium sulfide catalyst for
oxygen electroredn.)

IT **10049-08-8**, Ruthenium trichloride

(precursor for prepn. of ruthenium sulfide catalyst for oxygen
electroredn.)

IT **7782-44-7**, Oxygen, reactions

(ruthenium sulfide catalyst for redn. of)

L48 ANSWER 2 OF 4 HCA COPYRIGHT 2006 ACS on STN

137:232372 Selective hydrogenation of diethyl disulfide to ethanethiol
in the presence of sulfide catalysts. Mashkina, A. V.; Khairulina,
L. N. (Boreskov Institute of Catalysis, Siberian Division, Russian
Academy of Sciences, Novosibirsk, 630090, Russia). Kinetics and
Catalysis (Translation of Kinetika i Kataliz), 43(2), 261-267
(English) 2002. CODEN: KICAA8. ISSN: 0023-1584. OTHER SOURCES:
CASREACT 137:232372. Publisher: MAIK Nauka/Interperiodica
Publishing.

AB The gas-phase reaction of di-Et disulfide hydrogenation at atm.
pressure in the presence of supported transition metal sulfides was
studied. The reaction of di-Et disulfide with hydrogen at T =
200°C resulted in ethanethiol, and the selectivity to
ethanethiol was no lower than 94%. The selectivity decreased at a
higher temp. because of di-Et disulfide decompn. to ethylene and
hydrogen sulfide. The reaction of di-Et disulfide in the presence
of hydrogen occurred at a higher rate and selectivity than that in
an atm. of helium. The activity of metal sulfides supported on
aluminum oxide was higher than on the other studied
supports-aluminosilicate, silica gel, and a carbon support. Metal
sulfides supported on Al₂O₃ were arranged in the following order
according to their activity: Rh > Ru > Mo ≥ Pd > Ni > W.

Bimetallic catalysts were less active than monometallic catalysts. The activity of catalysts increased with the sulfide sulfur content; the partial redn. of metal sulfides also increased the catalytic activity.

IT **12653-56-4P**, Cobalt sulfide **37245-92-4P**, Ruthenium sulfide
(hydrogenation of di-Et disulfide to ethanethiol using supported sulfide catalysts)

RN 12653-56-4 HCA

CN Cobalt sulfide (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 37245-92-4 HCA

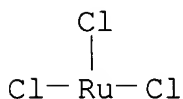
CN Ruthenium sulfide (7CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
S	x	7704-34-9
Ru	x	7440-18-8

IT **10049-08-8**, Ruthenium chloride (RuCl₃)
(hydrogenation of di-Et disulfide to ethanethiol using supported sulfide catalysts)

RN 10049-08-8 HCA

CN Ruthenium chloride (RuCl₃) (6CI, 8CI, 9CI) (CA INDEX NAME)



CC 23-9 (Aliphatic Compounds)

IT 11113-75-0P, Nickel sulfide 12612-50-9P, Molybdenum sulfide
12627-71-3P, Tungsten sulfide 12648-43-0P, Palladium sulfide
12653-56-4P, Cobalt sulfide 37245-91-3P, Rhodium sulfide
37245-92-4P, Ruthenium sulfide

(hydrogenation of di-Et disulfide to ethanethiol using supported sulfide catalysts)

IT 110-81-6, Diethyl disulfide 1333-74-0, Hydrogen, reactions
7647-10-1, Palladium chloride (PdCl₂) 7718-54-9, Nickel chloride
(NiCl₂), reactions 10049-07-7, Rhodium chloride (RhCl₃)
10049-08-8, Ruthenium chloride (RuCl₃) 12027-67-7,
Ammonium heptamolybdate [(NH₄)₆Mo₇O₂₄] 12028-06-7, Ammonium
heptatungstate [(NH₄)₆Mo₇O₂₄] 13138-45-9, Nickel nitrate
(hydrogenation of di-Et disulfide to ethanethiol using supported sulfide catalysts)

115:119521 Process for treating wastewater. Harada, Yoshiaki; Yamasaki, Kenichi (Osaka Gas Co., Ltd., Japan). Eur. Pat. Appl. EP 413356 A1 19910220, 16 pp. DESIGNATED STATES: R: DE, FR, GB, IT, NL. (English). CODEN: EPXXDW. APPLICATION: EP 1990-115812 19900817. PRIORITY: JP 1989-213987 19890818.

AB Wastewater contg. suspended solids, COD, and NH₃-N is treated by wet oxidn. with an O-contg. **gas** without a catalyst in a 1st stage, followed by wet oxidn. with an O-contg. **gas** in the presence of a catalyst supported on a granular carrier in a 2nd stage.. The catalyst comprises ≥ 1 of Fe, Co, Mn, Ni, Ru, Ph, Pd, Ir, Pt, Cu, Au, and W and/or their oxides, chlorides, or sulfides which are insol. or sparingly sol. in water. The treated water is then digested anaerobically to produce CH₄ and the excess sludge from the digestion is recycled. The pH of the influent is 6-9 and the temp. is 200-300°. The anaerobic stage is carried out at 35-60° and a sludge concn. of 2-5% for 1-30 days.

IT **12648-62-3**, Ruthenium chloride **12653-56-4**, Cobalt sulfide **37245-92-4**, Ruthenium sulfide (catalysts contg., for wastewater oxidn.)

RN 12648-62-3 HCA

CN Ruthenium chloride (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
Cl	x	22537-15-1
Ru	x	7440-18-8

RN 12653-56-4 HCA

CN Cobalt sulfide (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 37245-92-4 HCA

CN Ruthenium sulfide (7CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
S	x	7704-34-9
Ru	x	7440-18-8

IC ICM C02F011-08

ICS C02F001-72

CC 60-1 (Waste Treatment and Disposal)

IT 1313-99-1, Nickel oxide, uses and miscellaneous 1314-35-8, Tungsten oxide, uses and miscellaneous 1332-37-2, Iron oxide, uses and miscellaneous 1344-67-8, Copper chloride 1344-70-3, Copper oxide 7439-88-5, Iridium, uses and miscellaneous 7439-89-6,

Iron, uses and miscellaneous 7439-96-5, Manganese, uses and miscellaneous 7440-02-0, Nickel, uses and miscellaneous 7440-05-3, Palladium, uses and miscellaneous 7440-06-4, Platinum, uses and miscellaneous 7440-16-6, Rhodium, uses and miscellaneous 7440-18-8, Ruthenium, uses and miscellaneous 7440-33-7, Tungsten, uses and miscellaneous 7440-48-4, Cobalt, uses and miscellaneous 7440-50-8, Copper, uses and miscellaneous 7440-57-5, Gold, uses and miscellaneous 7647-10-1, Palladium chloride 7718-54-9, Nickel chloride, uses and miscellaneous 11104-61-3, Cobalt oxide 11113-75-0, Nickel sulfide 11113-77-2, Palladium oxide 11113-84-1, Ruthenium oxide 11115-78-9, Copper sulfide 11118-27-7, Gold chloride 11126-12-8, Iron sulfide 11129-60-5, Manganese oxide 11129-89-8, Platinum oxide 11132-78-8, Manganese chloride 12040-57-2, Iron chloride 12627-62-2, Platinum sulfide 12627-71-3, Tungsten sulfide 12645-45-3, Iridium chloride 12645-46-4, Iridium oxide 12648-43-0, Palladium sulfide 12648-47-4, Platinum chloride 12648-57-6, Rhodium chloride 12648-62-3, Ruthenium chloride 12653-56-4, Cobalt sulfide 12680-36-3, Rhodium oxide 12687-82-0, Manganese sulfide 12795-66-3, Tungsten chloride 37245-91-3, Rhodium sulfide 37245-92-4, Ruthenium sulfide 39403-39-9, Gold oxide 52934-19-7, Iridium sulfide 126549-44-8, Gold sulfide (catalysts contg., for wastewater oxidn.)

L48 ANSWER 4 OF 4 HCA COPYRIGHT 2006 ACS on STN

92:155043 **Electrocatalytic** electrodes for the polysulfide redox system. Hodes, Gary; Manassen, Joost; Cahen, David (Plast. Res. Dep., Weizmann Inst. Sci., Rehovot, Israel). Journal of the Electrochemical Society, 127(3), 544-9 (English) 1980. CODEN: JESQAN. ISSN: 0013-4651.

AB Porous **electrocatalytic** electrodes for the polysulfide redox system, contg. 1 of various metallic sulfides (esp. of Co, Cu, Pb) are described. Emphasis is place on their use as counter electrodes in photoelectrochem. cells employing polysulfide electrolytes. Their activity is measured as a function of electrolyte temp. and compn. The ratio of S to S²⁻, and through it the local redox potential of the soln., is shown to be an important factor controlling electrode activity. The short and long term stability of the electrodes, as cathodes, is discussed, and it is shown that, when used in conjunction with photoanodes, Cu₂S and CoS may poison the photoelectrode surface, thereby reducing total cell efficiency.

IT 1317-42-6

(electrodes, **electrocatalytic**, for polysulfide redox systems, counter electrodes for photochem. cells in relation to)

RN 1317-42-6 HCA

CN Cobalt sulfide (CoS) (8CI, 9CI) (CA INDEX NAME)

Co=S

IT 12166-20-0
(electrolytic polarization of, in polysulfide electrolyte)
RN 12166-20-0 HCA
CN Ruthenium sulfide (RuS₂) (6CI, 7CI, 9CI) (CA INDEX NAME)

S=Ru=S

CC 72-7 (Electrochemistry)
Section cross-reference(s): 67, 74
ST **electrocatalytic** electrode polysulfide redox system;
copper sulfide counterelectrode photoelectrochem cell; cobalt
sulfide counterelectrode photoelectrochem cell; counterelectrode
sulfide photoelectrochem cell
IT 1317-42-6 22205-45-4
(electrodes, **electrocatalytic**, for polysulfide redox
systems, counter electrodes for photochem. cells in relation to)
IT 7440-06-4, properties 11101-35-2 11143-58-1 **12166-20-0**
(electrolytic polarization of, in polysulfide electrolyte)

=> D L49 1-20 CBIB ABS HITSTR HITIND

L49 ANSWER 1 OF 20 HCA COPYRIGHT 2006 ACS on STN
145:315732 Metal phosphate sols, metal nanoparticles, metal-chalcogenide
nanoparticles, and nanocomposites made therefrom. Ryang, Hong-Son
(Aps Laboratory, USA). U.S. Pat. Appl. Publ. US 2006199886 A1
20060907, 21pp. (English). CODEN: USXXCO. APPLICATION: US
2005-70626 20050302.
AB Disclosed are metal phosphate sols made by mixing at least one metal
alkoxide, at least one phosphate precursor, at least one
organosilane, a liq., and, optionally, a boron oxide compd. These
sols are useful as hosts for guest metal nanoparticles and
metal-chalcogenide nanoparticles to provide sols that exhibit
decreased aggregation or pptn. of the nanoparticles and improve the
compatibility of the nanoparticles with the matrixes in polymer
nanocomposites. The nanocomposites contg. metal nanoparticles may
be chalcogenized to provide nanocomposites contg. metal-chalcogenide
nanoparticles.
IT 7783-06-4, **Hydrogen sulfide**, reactions
(chalcogenizing agent; manuf. of stable metal phosphate sols
contg. metal nanoparticles or metal-chalcogenide nanoparticles
for prodn. of nanocomposites)
RN 7783-06-4 HCA
CN Hydrogen sulfide (H₂S) (8CI, 9CI) (CA INDEX NAME)

H₂S

IT **1317-42-6P**, Cobalt sulfide (CoS) **63986-02-7P**,
Ruthenium sulfide (RuS)
(nanoparticulate; manuf. of stable metal phosphate sols contg.
metal nanoparticles or metal-chalcogenide nanoparticles for
prodn. of nanocomposites)
RN 1317-42-6 HCA
CN Cobalt sulfide (CoS) (8CI, 9CI) (CA INDEX NAME)

Co=S

RN 63986-02-7 HCA
CN Ruthenium sulfide (RuS) (7CI, 9CI) (CA INDEX NAME)

Ru=S

INCL 524262000; 524556000; 524423000
CC 37-6 (Plastics Manufacture and Processing)
IT 62-55-5, Thioacetamide 62-56-6, Thiourea, reactions 75-15-0,
Carbon disulfide, reactions 1302-81-4, Aluminum sulfide
1302-82-5, Aluminum selenide 1305-84-6, Calcium selenide
1313-82-2, Sodium sulfide, reactions 1313-85-5, Sodium selenide
3385-94-2, Bis(trimethylsilylsulfide) 7704-34-9, Sulfur, reactions
7782-49-2, Selenium, reactions **7783-06-4, Hydrogen**
sulfide, reactions 7783-07-5, Hydrogen selenide
7783-09-7, Hydrogen telluride 12007-33-9, Boron sulfide (B₂S₃)
12013-57-9, Calcium telluride 12034-41-2, Sodium telluride
12039-13-3, Titanium sulfide (TiS₂) 12039-15-5, Zirconium sulfide
(ZrS₂) 12043-29-7, Aluminum telluride (Al₂Te₃) 12067-45-7,
Titanium selenide (TiSe₂) 12067-75-3, Titanium telluride (TiTe₂)
12166-47-1, Zirconium selenide (ZrSe₂) 12297-19-7, Boron selenide
(B₂Se₃) 13494-80-9, Tellurium, reactions 20548-54-3, Calcium
sulfide 32321-65-6, Zirconium telluride (ZrTe₂) 127672-81-5,
Boron telluride (B₂Te₃)
(calcogenizing agent; manuf. of stable metal phosphate sols
contg. metal nanoparticles or metal-chalcogenide nanoparticles
for prodn. of nanocomposites)
IT 1306-24-7P, Cadmium selenide (CdSe), preparation 1306-25-8P,
Cadmium telluride (CdTe), preparation 1307-99-9P, Cobalt selenide
(CoSe) 1310-32-3P, Iron selenide (FeSe) 1313-22-0P, Manganese
selenide (MnSe) 1314-05-2P, Nickel selenide (NiSe) 1314-98-3P,
Zinc sulfide (ZnS), preparation 1315-09-9P, Zinc selenide (ZnSe)
1315-11-3P, Zinc telluride (ZnTe) 1317-37-9P, Iron sulfide (FeS)

1317-40-4P, Copper sulfide (CuS) 1317-41-5P, Copper selenide (CuSe) **1317-42-6P**, Cobalt sulfide (CoS) 1344-48-5P, Mercury sulfide 7429-90-5P, Aluminum, preparation 7429-91-6P, Dysprosium, preparation 7439-88-5P, Iridium, preparation 7439-89-6P, Iron, preparation 7439-91-0P, Lanthanum, preparation 7439-92-1P, Lead, preparation 7439-93-2P, Lithium, preparation 7439-94-3P, Lutetium, preparation 7439-95-4P, Magnesium, preparation 7439-96-5P, Manganese, preparation 7439-97-6P, Mercury, preparation 7439-98-7P, Molybdenum, preparation 7440-00-8P, Neodymium, preparation 7440-02-0P, Nickel, preparation 7440-03-1P, Niobium, preparation 7440-04-2P, Osmium, preparation 7440-05-3P, Palladium, preparation 7440-06-4P, Platinum, preparation 7440-09-7P, Potassium, preparation 7440-10-0P, Praseodymium, preparation 7440-15-5P, Rhenium, preparation 7440-16-6P, Rhodium, preparation 7440-17-7P, Rubidium, preparation 7440-18-8P, Ruthenium, preparation 7440-19-9P, Samarium, preparation 7440-20-2P, Scandium, preparation 7440-22-4P, Silver, preparation 7440-24-6P, Strontium, preparation 7440-25-7P, Tantalum, preparation 7440-26-8P, Technetium, preparation 7440-27-9P, Terbium, preparation 7440-28-0P, Thallium, preparation 7440-29-1P, Thorium, preparation 7440-30-4P, Thulium, preparation 7440-31-5P, Tin, preparation 7440-32-6P, Titanium, preparation 7440-33-7P, Tungsten, preparation 7440-36-0P, Antimony, preparation 7440-38-2P, Arsenic, preparation 7440-39-3P, Barium, preparation 7440-41-7P, Beryllium, preparation 7440-43-9P, Cadmium, preparation 7440-45-1P, Cerium, preparation 7440-47-3P, Chromium, preparation 7440-48-4P, Cobalt, preparation 7440-50-8P, Copper, preparation 7440-52-0P, Erbium, preparation 7440-53-1P, Europium, preparation 7440-54-2P, Gadolinium, preparation 7440-55-3P, Gallium, preparation 7440-57-5P, Gold, preparation 7440-58-6P, Hafnium, preparation 7440-60-0P, Holmium, preparation 7440-61-1P, Uranium, preparation 7440-62-2P, Vanadium, preparation 7440-64-4P, Ytterbium, preparation 7440-65-5P, Yttrium, preparation 7440-66-6P, Zinc, preparation 7440-67-7P, Zirconium, preparation 7440-69-9P, Bismuth, preparation 7440-70-2P, Calcium, preparation 7440-74-6P, Indium, preparation 12002-86-7P, Silver selenide (AgSe) 12017-13-9P, Cobalt telluride (CoTe) 12018-06-3P, Chromium sulfide (CrS) 12019-23-7P, Copper telluride (CuTe) 12032-88-1P, Manganese telluride (MnTe) 12037-94-4P, Palladium telluride (PdTe) 12038-20-9P, Platinum sulfide (PtS) 12053-13-3P, Chromium selenide (CrSe) 12053-15-5P, Chromium telluride (CrTe) 12068-90-5P, Mercury telluride (HgTe) 12125-22-3P, Palladium sulfide (PdS) 12125-63-2P, Iron telluride (FeTe) 12136-40-2P, Iridium sulfide (IrS) 12137-76-7P, Palladium selenide (PdSe) 12137-99-4P, Rhodium sulfide (RhS) 12142-88-0P, Nickel telluride (NiTe) 12163-71-2P, Molybdenum telluride (MoTe) 12165-97-8P, Platinum selenide (PtSe) 12166-00-6P, Platinum

telluride (PtTe) 12166-27-7P, Vanadium sulfide (VS) 12187-00-7P,
 Vanadium selenide (VSe) 12196-61-1P, Iridium telluride (IrTe)
 12249-63-7P, Silver sulfide (AgS) 12249-68-2P, Silver telluride
 (AgTe) 12286-14-5P, Molybdenum selenide (MoSe) 16812-54-7P,
 Nickel sulfide (NiS) 18820-29-6P, Manganese sulfide (MnS)
 20601-83-6P, Mercury selenide (HgSe) 20820-34-2P, Molybdenum
 sulfide (MoS) 23331-11-5P, Gold selenide (AuSe) 29306-15-8P,
 Gold sulfide (AuS) 29888-22-0P, Vanadium telluride (VTe)
 32152-95-7P, Rhenium sulfide (ReS) 32368-66-4P, Rhenium telluride
 (ReTe) 34912-97-5P, Rhenium selenide (ReSe) 37043-71-3P, Gold
 telluride (AuTe) 59225-03-5P, Rhodium telluride (RhTe)
 60864-29-1P, Rhodium selenide (RhSe) 63986-01-6P, Ruthenium
 selenide (RuSe) **63986-02-7P**, Ruthenium sulfide (RuS)
 100437-61-4P, Osmium sulfide (OsS) 100774-51-4P, Ruthenium
 telluride (RuTe) 908568-66-1P 908568-67-2P 908568-68-3P
 (nanoparticulate; manuf. of stable metal phosphate sols contg.
 metal nanoparticles or metal-chalcogenide nanoparticles for
 prodn. of nanocomposites)

L49 ANSWER 2 OF 20 HCA COPYRIGHT 2006 ACS on STN

144:420515 On the interpretation of temperature programmed reduction
 patterns of transition metals sulphides. Afanasiev, P. (Institut de
 Recherches sur la Catalyse, CNRS, Villeurbanne, 69626, Fr.).
 Applied Catalysis, A: General, 303(1), 110-115 (English) 2006.
 CODEN: ACAGE4. ISSN: 0926-860X. Publisher: Elsevier B.V..

AB Transition metal sulfides show the temp. programmed redn. (TPR)
 patterns consisting of multiple redn. domains: those at lower temps.
 are attributed to the "weakly bonded" sulfur, whereas the "bulk
 redn." peaks are usually placed at high temps. The present paper is
 focusing attention on the last type TPR maxima. Due to the pos.
 free energy of redn. of **catalytically** important sulfides,
 their TPR at high temps. is controlled by thermodyn. For several
 bulk and supported sulfides, the ascending branch of the "bulk
 redn." event might be transformed to a linear ($\ln[H_2S]$
 $-1/T$) plot from which std. enthalpy of redn. can be reliably extd.
 with good precision. Thermodyn. of sulfur abstraction from mixed
 sulfides (Mo-W sulfides, chromium thiospinels), or from highly
 dispersed bulk and supported systems can be estd. and compared using
 this approach.

IT **12016-70-5**, Chromium cobalt sulfide (Cr₂CoS₄)
12017-76-4, Cobalt sulfide(cos0.89) **12166-20-0**,
 Ruthenium disulfide
 (interpretation of temp. programmed redn. patterns of transition
 metals sulfides)

RN 12016-70-5 HCA

CN Chromium cobalt sulfide (Cr₂CoS₄) (7CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component
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		Registry Number
=====+=====+=====		
S	4	7704-34-9
Co	1	7440-48-4
Cr	2	7440-47-3

RN 12017-76-4 HCA

CN Cobalt sulfide (Co9S8) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====+=====+=====		
S	8	7704-34-9
Co	9	7440-48-4

RN 12166-20-0 HCA

CN Ruthenium sulfide (RuS2) (6CI, 7CI, 9CI) (CA INDEX NAME)



CC 67-3 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)

Section cross-reference(s): 69

IT **Catalysts**

Free energy of formation

Reduction enthalpy

(interpretation of temp. programmed redn. patterns of transition metals sulfides)

IT 1317-33-5, Molybdenum disulfide, uses 1317-40-4, Copper sulfide (CuS) **12016-70-5**, Chromium cobalt sulfide (Cr2CoS4) **12017-76-4**, Cobalt sulfide (cos0.89) 12035-51-7, Nickel disulfide 12035-72-2, Nickel sulfide (Ni3S2) 12133-39-0, Cadmium chromium sulfide (CdCr2S4) **12166-20-0**, Ruthenium disulfide (interpretation of temp. programmed redn. patterns of transition metals sulfides)

L49 ANSWER 3 OF 20 HCA COPYRIGHT 2006 ACS on STN

139:247722 Combinatorial Computational Chemistry Approach to the High-Throughput Screening of Metal Sulfide **Catalysts** for CO Hydrogenation Process. Kubo, Momoji; Kubota, Tsuguo; Jung, Changho; Seki, Kōtaro; Takami, Seiichi; Koizumi, Naoto; Omata, Kohji; Yamada, Muneyoshi; Miyamoto, Akira (Department of Materials Chemistry, Graduate School of Engineering, Tohoku University, Sendai, 980-8579, Japan). Energy & Fuels, 17(4), 857-861 (English) 2003. CODEN: ENFUEM. ISSN: 0887-0624. Publisher: American Chemical Society.

AB The authors have already proposed that a Combinatorial Computational

Chem. approach is very effective for performing the theor. high-throughput screening of new **catalysts**, and its validity was strongly confirmed in various **catalyst** systems. The authors applied the combinatorial computational chem. approach to the design of new metal sulfide **catalysts** for the CO hydrogenation process and proposed new guidance for designing the highly selective **catalysts** for methanol synthesis. The authors studied H₂ and CO adsorption on a large no. of metal and metal sulfide **catalysts** by 1st-principles calcns., and succeeded in clarifying the relation between the metal species in the metal and metal sulfide **catalysts** and the products of the CO hydrogenation processes. Co, Mo, Ru, Rh, Ir, and Pd sulfide **catalysts** selectively produce methanol, while Re and Os sulfide **catalysts** selectively produce hydrocarbons. The above results are in good agreement with the exptl. results of Koizumi and co-workers. Also, probably the Pd sulfide **catalyst** has the highest selectivity for methanol from the CO hydrogenation process. This result strongly supports the exptl. results by Koizumi and co-workers. Also, probably the metal sulfide **catalysts**, which realize the bridge-site adsorption of the CO mol. on both the metal and sulfur atoms, have high selectivity for methanol. This proposed guidance for designing the highly selective metal sulfide **catalysts** for methanol may be useful for the expts.

IT 7440-18-8, Ruthenium, properties 7440-48-4,
Cobalt, properties
(binding energy and bond distance calcns. of M-M bonds)

RN 7440-18-8 HCA

CN Ruthenium (8CI, 9CI) (CA INDEX NAME)

Ru

RN 7440-48-4 HCA

CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT 1317-42-6, Cobalt sulfide 63986-02-7, Ruthenium
sulfide (RuS)
(binding energy, metal charge, and bond distance calcns. of M-S
bonds; combinatorial computational chem. approach to
high-throughput screening of metal sulfide **catalysts**
for CO hydrogenation process)

RN 1317-42-6 HCA

CN Cobalt sulfide (CoS) (8CI, 9CI) (CA INDEX NAME)

Co=S

RN 63986-02-7 HCA

CN Ruthenium sulfide (RuS) (7CI, 9CI) (CA INDEX NAME)

Ru=S

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)

Section cross-reference(s): 67

ST combinatorial computational chem high throughput screening metal sulfide **catalyst**; Fischer Tropsch CO hydrogenation methanol hydrocarbon metal sulfide **catalysis**

IT Fischer-Tropsch **catalysts**

Fischer-Tropsch reaction

High throughput screening

Local density approximation

(combinatorial computational chem. approach to high-throughput screening of metal sulfide **catalysts** for CO hydrogenation process).

IT Sulfides, uses

(combinatorial computational chem. approach to high-throughput screening of metal sulfide **catalysts** for CO hydrogenation process)

IT Hydrocarbons, preparation

(combinatorial computational chem. approach to high-throughput screening of metal sulfide **catalysts** for CO hydrogenation process)

IT Chemistry

(computational; combinatorial computational chem. approach to high-throughput screening of metal sulfide **catalysts** for CO hydrogenation process)

IT Adsorption energy

(of hydrogen onto metals and sulfide **catalysts**, calcd.; binding energy and bond distance calcns. of M-M bonds)

IT 7439-88-5, Iridium, properties 7439-98-7, Molybdenum, properties
7440-04-2, Osmium, properties 7440-05-3, Palladium, properties
7440-15-5, Rhenium, properties 7440-16-6, Rhodium, properties
7440-18-8, Ruthenium, properties **7440-48-4**,
Cobalt, properties

(binding energy and bond distance calcns. of M-M bonds)

IT **1317-42-6**, Cobalt sulfide 12125-22-3, Palladium sulfide
(PdS) 12137-99-4, Rhodium sulfide (RhS) 20820-34-2, Molybdenum
sulfide (MoS) 32152-95-7, Rhenium sulfide (ReS) **63986-02-7**
, Ruthenium sulfide (RuS) 100437-61-4, Osmium sulfide (OsS)
(binding energy, metal charge, and bond distance calcns. of M-S
bonds; combinatorial computational chem. approach to

high-throughput screening of metal sulfide **catalysts**
for CO hydrogenation process)

IT 67-56-1P, Methanol, preparation
(combinatorial computational chem. approach to high-throughput
screening of metal sulfide **catalysts** for CO
hydrogenation process)

L49 ANSWER 4 OF 20 HCA COPYRIGHT 2006 ACS on STN

132:66355 HDS, HDN and HYD activities and temperature-programmed
reduction of unsupported transition metal sulfides. Jacobsen, Claus
J. H.; Tornqvist, Eric; Topsoe, Henrik (Haldor Topsoe Research
Laboratories, Lyngby, DK-2800, Den.). Catalysis Letters, 63(3,4),
179-183 (English) 1999. CODEN: CALEER. ISSN: 1011-372X.
Publisher: Baltzer Science Publishers.

AB Several transition metal sulfides have been shown to exhibit high
catalytic activities in various hydrotreating reactions. The
simultaneous catalytic activities for hydrodesulfurization of
dibenzothiophene, hydrodenitrogenation of indole and hydrogenation
of naphthalene have been studied using high surface area bulk
sulfides: NbS₂, MoS₂, ReS₂, RuS₂ and Co₉S₈. The metal-sulfur bond
strengths have been assessed by temp.-programmed redn. of
H₂S-pretreated sulfides, and it is demonstrated that this
pretreatment is necessary to obtain reliable TPR data for the
sulfides. The catalytic HDS activity is shown to follow the trend
in the metal-sulfur bond strengths estd. by this improved method.
Furthermore, the metal-sulfur bond strengths detd. this way follow
the trend estd. previously from theory. The TPR data suggest that a
large no. of sulfur vacancies exist in active catalysts under
industrial reaction conditions. Such vacancies have recently been
obsd. on model catalysts by use of STM.

IT **12017-76-4**, Cobalt sulfide (Co₉S₈) **12166-20-0**,
Ruthenium disulfide

(HDS, HDN and HYD activities and temp.-programmed redn. of
unsupported transition metal sulfides)

RN 12017-76-4 HCA

CN Cobalt sulfide (Co₉S₈) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
S	8	7704-34-9
Co	9	7440-48-4

RN 12166-20-0 HCA

CN Ruthenium sulfide (RuS₂) (6CI, 7CI, 9CI) (CA INDEX NAME)



- CC 51-6 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67
- IT 1317-33-5, Molybdenum disulfide, uses **12017-76-4**, Cobalt sulfide (Co₉S₈) 12038-63-0, Rhenium disulfide 12136-97-9, Niobium disulfide **12166-20-0**, Ruthenium disulfide (HDS, HDN and HYD activities and temp.-programmed redn. of unsupported transition metal sulfides)
- L49 ANSWER 5 OF 20 HCA COPYRIGHT 2006 ACS on STN
- 130:99782 **Catalytic** removal of sulfur dioxide from flue gas.
Fang, Ming; Ma, Jian-Xin (The Hong Kong University of Science & Technology, Hong Kong). U.S. US 5853684 A 19981229, 10 pp., Cont. of U.S. Ser. No. 558,694, abandoned. (English). CODEN: USXXAM.
APPLICATION: US 1997-914615 19970821. PRIORITY: US 1995-558694 19951114.
- AB The present invention provides novel **catalysts** for the simultaneous removal of SO₂ and NO_x from flue gases. The **catalysts** may be supported or unsupported, pretreated or untreated, but allow the simultaneous redn. of SO₂ to S and NO_x to N₂. Elemental S can be recovered as a byproduct.
- IT **12013-10-4**, Cobalt sulfide (CoS₂) **12166-20-0**, Ruthenium sulfide (RuS₂)
(**catalytic** removal of sulfur dioxide from flue gas)
- RN 12013-10-4 HCA
- CN Cobalt sulfide (CoS₂) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)



- RN 12166-20-0 HCA
- CN Ruthenium sulfide (RuS₂) (6CI, 7CI, 9CI) (CA INDEX NAME)



- IT **12016-86-3**, Cobalt lanthanum oxide (CoLaO₃)
108916-09-2, Cobalt lanthanum strontium oxide
(CoLa_{0.8}Sr_{0.2}O₃) **219476-98-9**, Cobalt lanthanum oxide
(Co_{0.8}La_{0.2}O₃)
(**catalytic** removal of sulfur dioxide from flue gas)
- RN 12016-86-3 HCA
- CN Cobalt lanthanum oxide (CoLaO₃) (8CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====+	=====+	=====
O	3	17778-80-2

Co	1	7440-48-4
La	1	7439-91-0

RN 108916-09-2 HCA

CN Cobalt lanthanum strontium oxide (CoLa0.8Sr0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Co	1	7440-48-4
Sr	0.2	7440-24-6
La	0.8	7439-91-0

RN 219476-98-9 HCA

CN Cobalt lanthanum oxide (Co0.8La0.2O3) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3	17778-80-2
Co	0.8	7440-48-4
La	0.2	7439-91-0

IC ICM B01J008-00

INCL 423244100

CC 59-4 (Air Pollution and Industrial Hygiene)

ST sulfur dioxide removal flue gas **catalyst**; nitrogen oxide removal flue gas **catalyst**IT **Catalyst** supports**Catalysts**

Flue gas desulfurization

Flue gases

(catalytic removal of sulfur dioxide from flue gas)

IT Aluminosilicates, uses

Zeolites (synthetic), uses

(catalytic removal of sulfur dioxide from flue gas)

IT 7446-09-5, Sulfur dioxide, occurrence

(air pollution; catalytic removal of sulfur dioxide from flue gas)

IT 7704-34-9P, Sulfur, processes

(catalytic removal of sulfur dioxide from flue gas)

IT 1303-86-2, Boria, uses 1314-20-1, Thoria, uses 1314-23-4,
 Zirconia, uses 1314-96-1, Strontium sulfide (SrS) 1344-28-1,
 Alumina, uses 10099-60-2 **12013-10-4**, Cobalt sulfide
 (CoS2) 12031-43-5, Lanthanum oxide sulfide (La2O2S)
12166-20-0, Ruthenium sulfide (RuS2) 12201-11-5, Lanthanum

- oxide sulfate ($\text{La}_2\text{O}_3(\text{SO}_4)$) 13463-67-7, Titania, uses
(**catalytic** removal of sulfur dioxide from flue gas)
- IT 74-82-8, Methane, processes 555-31-7 630-08-0, Carbon monoxide,
processes 1312-81-8, Lanthanum oxide 1333-74-0, Hydrogen,
processes 7664-41-7, Ammonia, processes 7697-37-2, Nitric acid,
processes 10099-59-9, Lanthanum nitrate **12016-86-3**,
Cobalt lanthanum oxide (CoLaO_3) **108916-09-2**, Cobalt
lanthanum strontium oxide ($\text{CoLa}_{0.8}\text{Sr}_{0.2}\text{O}_3$) **219476-98-9**,
Cobalt lanthanum oxide ($\text{Co}_{0.8}\text{La}_{0.2}\text{O}_3$)
(**catalytic** removal of sulfur dioxide from flue gas)
- IT 7446-09-5, Sulfur dioxide, processes 11104-93-1, Nitrogen oxide
(NO_x), processes
(**catalytic** removal of sulfur dioxide from flue gas)
- L49 ANSWER 6 OF 20 HCA COPYRIGHT 2006 ACS on STN
126:332338 High-pressure temperature-programmed reduction of sulfided
catalysts. Labruyere, Franck; Lacroix, Michel; Schweich,
Daniel; Breysse, Michele (Institut de Recherches sur la Catalyse,
Villeurbanne, 69626, Fr.). Journal of Catalysis, 167(2), 464-469
(English) 1997. CODEN: JCTLA5. ISSN: 0021-9517. Publisher:
Academic.
- AB A new exptl. temp.-programmed redn. set-up was designed for
operation at H_2 pressures >1 atm, esp. for evaluation and
characterization of sulfided petroleum refining **catalysts**.
Basic hydrodynamic considerations were used for correcting the
signal from the variations of the residence time distribution of the
mols. in the reactor. Model and industrial sulfide
catalysts were studied at various pressures. When the raw
signals are suitably cor., it appears that the hydrogen pressure
does not influence the TPR patterns. Instead, it was suggested that
the limiting step in temp.-programmed redn. of the sulfided
catalysts is metal-sulfur bond cleavage.
- IT **12653-56-4**, Cobalt sulfide **37245-92-4**, Ruthenium
sulfide
(formation and redn. of; high-pressure temp.-programmed redn. of
sulfided petroleum refining **catalysts**)
- RN 12653-56-4 HCA
CN Cobalt sulfide (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
RN 37245-92-4 HCA
CN Ruthenium sulfide (7CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
S	x	7704-34-9
Ru	x	7440-18-8

IT 7440-18-8, Ruthenium, uses 7440-48-4, Cobalt, uses
(high-pressure temp.-programmed redn. of sulfided petroleum
refining **catalysts**)

RN 7440-18-8 HCA

CN Ruthenium (8CI, 9CI) (CA INDEX NAME)

Ru

RN 7440-48-4 HCA

CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

CC 51-9 (Fossil Fuels, Derivatives, and Related Products)

Section cross-reference(s): 67

ST temp programmed redn sulfided petroleum **catalyst**; cobalt
sulfide temp programmed redn; molybdenum sulfide temp programmed
redn; ruthenium sulfide temp programmed redn

IT Petroleum hydrotreating **catalysts**

Sulfidation

(high-pressure temp.-programmed redn. of sulfided petroleum
refining **catalysts**)

IT Bond cleavage

(metal-sulfur, limiting step; in high-pressure temp.-programmed
redn. of sulfided petroleum refining **catalysts**)

IT Petroleum refining **catalysts**

(sulfided; high-pressure temp.-programmed redn. of sulfided
petroleum refining **catalysts**)

IT Reduction

(thermal; high-pressure temp.-programmed redn. of sulfided
petroleum refining **catalysts**)

IT 12612-50-9, Molybdenum sulfide 12653-56-4, Cobalt sulfide

37245-92-4, Ruthenium sulfide

(formation and redn. of; high-pressure temp.-programmed redn. of
sulfided petroleum refining **catalysts**)

IT 7439-98-7, Molybdenum, uses 7440-18-8, Ruthenium, uses

7440-48-4, Cobalt, uses

(high-pressure temp.-programmed redn. of sulfided petroleum
refining **catalysts**)

L49 ANSWER 7 OF 20 HCA COPYRIGHT 2006 ACS on STN

120:145432 Hydrogenation and hydrodesulfurization properties of simple
and mixed transition metal sulfides. Bellaloui, A.;
Nechadi-Boutarfa, N.; Breysse, M.; Lacroix, M.; Mosoni, L.; Roubin,
M.; Vrinat, M. (Inst. Rech. Catal., CNRS, Villeurbanne, 69626, Fr.).
Colloq. Fr.-Maghreb Catal., 1st, Meeting Date 1990, Volume 2,

427-34. Editor(s): Ghorbel, A. Inst. Rech. Catal.: Villeurbanne, Fr. (French) 1993. CODEN: 59TSA5.

AB **Catalytic** activities of transition metal sulfides (THS) were detd. for biphenyl hydrogenation under medium high pressure conditions. Except V₂S₃, the first-row TMS are relatively inactive, and for the second- and third-row sulfides Nb, Ru and Rh are of particular interest. For RuS₂, solid solns. M_xRu_{1-x}S₂ (M = Fe, Co, Ni) could be prep'd. over the whole range of compns.; a correlation was established in hydrogenation and hydrodesulfurization reactions with the properties of molybdenum sulfide promoted by the same elements. Similarities suggest that in both cases the promoting effect is due to the existence of mixed sites, whose electronic and **catalytic** properties are related to the nature of the components.

IT **12166-20-0**, Ruthenium disulfide **12653-56-4**, Cobalt sulfide **59787-35-8**, Cobalt molybdenum sulfide **110831-66-8**, Nickel ruthenium sulfide (Ni_{0.8}Ru_{0.2}S₂) **110831-67-9**, Nickel ruthenium sulfide (Ni_{0.6}Ru_{0.4}S₂) **127673-39-6**, Iron ruthenium sulfide (Fe_{0.5}Ru_{0.5}S₂) **127673-64-7**, Cobalt ruthenium sulfide (Co_{0.6}Ru_{0.4}S₂) **127673-65-8**, Cobalt ruthenium sulfide (Co_{0.8}Ru_{0.2}S₂) **127689-83-2**, Cobalt ruthenium sulfide (Co_{0.3}Ru_{0.7}S₂) (**catalyst**, for hydrogenation and hydrodesulfurization)

RN 12166-20-0 HCA

CN Ruthenium sulfide (RuS₂) (6CI, 7CI, 9CI) (CA INDEX NAME)



RN 12653-56-4 HCA

CN Cobalt sulfide (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 59787-35-8 HCA

CN Cobalt molybdenum sulfide (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
S	x	7704-34-9
Co	x	7440-48-4
Mo	x	7439-98-7

RN 110831-66-8 HCA

CN Nickel ruthenium sulfide (Ni_{0.8}Ru_{0.2}S₂) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number

S		2		7704-34-9
Ru		0.2		7440-18-8
Ni		0.8		7440-02-0

RN 110831-67-9 HCA

CN Nickel ruthenium sulfide (Ni_{0.6}Ru_{0.4}S₂) (9CI) (CA INDEX NAME)

Component		Ratio		Component Registry Number
=====				
S		2		7704-34-9
Ru		0.4		7440-18-8
Ni		0.6		7440-02-0

RN 127673-39-6 HCA

CN Iron ruthenium sulfide (Fe_{0.5}Ru_{0.5}S₂) (9CI) (CA INDEX NAME)

Component		Ratio		Component Registry Number
=====				
S		2		7704-34-9
Ru		0.5		7440-18-8
Fe		0.5		7439-89-6

RN 127673-64-7 HCA

CN Cobalt ruthenium sulfide (Co_{0.6}Ru_{0.4}S₂) (9CI) (CA INDEX NAME)

Component		Ratio		Component Registry Number
=====				
S		2		7704-34-9
Co		0.6		7440-48-4
Ru		0.4		7440-18-8

RN 127673-65-8 HCA

CN Cobalt ruthenium sulfide (Co_{0.8}Ru_{0.2}S₂) (9CI) (CA INDEX NAME)

Component		Ratio		Component Registry Number
=====				
S		2		7704-34-9
Co		0.8		7440-48-4
Ru		0.2		7440-18-8

RN 127689-83-2 HCA

CN Cobalt ruthenium sulfide (Co_{0.3}Ru_{0.7}S₂) (9CI) (CA INDEX NAME)

Component		Ratio		Component
-----------	--	-------	--	-----------

		Registry Number
S	2	7704-34-9
Co	0.3	7440-48-4
Ru	0.7	7440-18-8

- CC 67-1 (Catalysis, Reaction Kinetics, and Inorganic Reaction Mechanisms)
Section cross-reference(s): 45, 51
- ST transition metal sulfide hydrogenation hydrodesulfurization **catalyst**
- IT Transition metal sulfides
(**catalysts**, for hydrogenation and hydrodesulfurization)
- IT Hydrogenation **catalysts**
(transition metal sulfides, prepn. and properties of)
- IT Desulfurization **catalysts**
(reductive, transition metal sulfides, prepn. and properties of)
- IT 1306-23-6, Cadmium monosulfide, uses 1314-98-3, Zinc sulfide, uses 1315-03-3, Vanadium sulfide (V₂S₃) 1317-33-5, Molybdenum disulfide, uses 1317-37-9, Iron monosulfide 12018-22-3, Chromium sulfide (Cr₂S₃) 12039-13-3, Titanium disulfide 12039-15-5, Zirconium disulfide 12067-06-0, Rhodium sulfide (Rh₂S₃) 12125-22-3, Palladium monosulfide 12138-09-9, Tungsten disulfide **12166-20-0**, Ruthenium disulfide 12316-04-0, Niobium trisulfide **12653-56-4**, Cobalt sulfide 16812-54-7, Nickel monosulfide 18820-29-6, Manganese monosulfide 18855-94-2, Hafnium disulfide 22205-45-4, Copper sulfide (Cu₂S) 37299-85-7, Rhenium sulfide **59787-35-8**, Cobalt molybdenum sulfide 59787-36-9, Iron molybdenum sulfide 59787-38-1, Molybdenum nickel sulfide **110831-66-8**, Nickel ruthenium sulfide (Ni_{0.8}Ru_{0.2}S₂) **110831-67-9**, Nickel ruthenium sulfide (Ni_{0.6}Ru_{0.4}S₂) **127673-39-6**, Iron ruthenium sulfide (Fe_{0.5}Ru_{0.5}S₂) **127673-64-7**, Cobalt ruthenium sulfide (Co_{0.6}Ru_{0.4}S₂) **127673-65-8**, Cobalt ruthenium sulfide (Co_{0.8}Ru_{0.2}S₂) **127689-83-2**, Cobalt ruthenium sulfide (Co_{0.3}Ru_{0.7}S₂)
(**catalyst**, for hydrogenation and hydrodesulfurization)
- L49 ANSWER 8 OF 20 HCA COPYRIGHT 2006 ACS on STN
- 116:194146 Pprocess for the preparation of thiophene by gas-phase dehydrogenation of tetrahydrothiophene over a ruthenium sulfide-based catalyst.. Forquy, Christian; Lacroix, Michel; Breysse, Michele (Societe Nationale Elf Aquitaine (SNEA), Fr.). Eur. Pat. Appl. EP 475801 A1 19920318, 9 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE. (French). CODEN: EPXXDW. APPLICATION: EP 1991-402221 19910809. PRIORITY: FR 1990-10762 19900829.
- AB A process for the prepn. of thiophene comprises the gas-phase

dehydrogenation of tetrahydrothiophene over a ruthenium sulfide-based catalyst. The catalytic activity of other transition metal sulfides was also reported. Alumina was impregnated with ruthenium chloride, dried and treated with **H₂S**/nitrogen at 400°; for 4 h to give a catalyst contg. alumina-supported RuS₂. Gas-phase dehydrogenation of tetrahydrothiophene was carried out in a microreactor charged with the above catalyst at 380°; selectivity toward formation of thiophene was 92%.

IT **12653-56-4**, Cobalt sulfide
(gas-phase dehydrogenation catalyst contg. ruthenium sulfide and, for tetrahydrothiophene)
RN 12653-56-4 HCA
CN Cobalt sulfide (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
IT **12166-20-0**, Ruthenium sulfide (RuS₂)
(gas-phase dehydrogenation catalyst for tetrahydrothiophene)
RN 12166-20-0 HCA
CN Ruthenium sulfide (RuS₂) (6CI, 7CI, 9CI) (CA INDEX NAME)



IC ICM C07D333-10
CC 27-8 (Heterocyclic Compounds (One Hetero Atom))
IT 11126-12-8, Iron sulfide 11130-24-8, Vanadium sulfide
12612-50-9, Molybdenum sulfide 12623-97-1, Chromium sulfide
12627-71-3, Tungsten sulfide 12648-43-0, Palladium sulfide
12653-56-4, Cobalt sulfide 12687-82-0, Manganese sulfide
37245-91-3, Rhodium sulfide 39290-91-0, Niobium sulfide
(gas-phase dehydrogenation catalyst contg. ruthenium sulfide and, for tetrahydrothiophene)
IT **12166-20-0**, Ruthenium sulfide (RuS₂)
(gas-phase dehydrogenation catalyst for tetrahydrothiophene)

L49 ANSWER 9 OF 20 HCA COPYRIGHT 2006 ACS on STN

113:8351 **Catalytic** properties in hydrogenation and hydrodesulfurization reactions of ruthenium sulfide solid solutions containing iron, cobalt, or nickel. Vrinat, M.; Lacroix, M.; Breysse, M.; Mosoni, L.; Roubin, M. (Inst. Rech. Catal., Villeurbanne, 69626, Fr.). Catalysis Letters, 3(5-6), 405-12 (English) 1989. CODEN: CALEER. ISSN: 1011-372X.

AB The title solid solns. MxRu_{1-x}S₂ M = Ni, Co, Fe) were prep'd. by sulfidation of mixts. of hydroxides at 673 K and their crystallog. properties were studied by x-ray diffraction. The sulfides were used to hydrogenate biphenyl and in the hydrodesulfurization of thiophene. The Co-Ru **catalysts** showed good activity for hydrodesulfurization but very low activity for hydrogenation, while Fe-Ru **catalysts** had low activity for both reactions.

Ni-Ru **catalysts** had twice the activity of Ru₂S.

IT 110831-66-8, Nickel ruthenium sulfide (Ni_{0.8}Ru_{0.2}S₂)
 110831-67-9, Nickel ruthenium sulfide (Ni_{0.6}Ru_{0.4}S₂)
 127673-39-6, Iron ruthenium sulfide (Fe_{0.5}Ru_{0.5}S₂)
 127673-63-6, Iron ruthenium sulfide (Fe_{0.8}Ru_{0.2}S₂)
 127673-64-7, Cobalt ruthenium sulfide (Co_{0.6}Ru_{0.4}S₂)
 127673-65-8, Cobalt ruthenium sulfide (Co_{0.8}Ru_{0.2}S₂)
 127689-83-2, Cobalt ruthenium sulfide (Co_{0.3}Ru_{0.7}S₂)
 (**catalysts**, for hydrogenation of biphenyl and
 hydrodesulfurization of thiophene, activity of)

RN 110831-66-8 HCA
 CN Nickel ruthenium sulfide (Ni_{0.8}Ru_{0.2}S₂) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
S	2	7704-34-9
Ru	0.2	7440-18-8
Ni	0.8	7440-02-0

RN 110831-67-9 HCA
 CN Nickel ruthenium sulfide (Ni_{0.6}Ru_{0.4}S₂) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
S	2	7704-34-9
Ru	0.4	7440-18-8
Ni	0.6	7440-02-0

RN 127673-39-6 HCA
 CN Iron ruthenium sulfide (Fe_{0.5}Ru_{0.5}S₂) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
S	2	7704-34-9
Ru	0.5	7440-18-8
Fe	0.5	7439-89-6

RN 127673-63-6 HCA
 CN Iron ruthenium sulfide (Fe_{0.8}Ru_{0.2}S₂) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
S	2	7704-34-9
Ru	0.2	7440-18-8

Fe | 0.8 | 7439-89-6

RN 127673-64-7 HCA

CN Cobalt ruthenium sulfide (Co0.6Ru0.4S2) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
S	2	7704-34-9
Co	0.6	7440-48-4
Ru	0.4	7440-18-8

RN 127673-65-8 HCA

CN Cobalt ruthenium sulfide (Co0.8Ru0.2S2) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
S	2	7704-34-9
Co	0.8	7440-48-4
Ru	0.2	7440-18-8

RN 127689-83-2 HCA

CN Cobalt ruthenium sulfide (Co0.3Ru0.7S2) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
S	2	7704-34-9
Co	0.3	7440-48-4
Ru	0.7	7440-18-8

CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)

ST biphenyl hydrogenation **catalyst**; thiophene

hydrodesulfurization **catalyst**; **catalyst**

ruthenium sulfide solid soln; iron ruthenium sulfide

catalyst; cobalt ruthenium sulfide **catalyst**;

nickel ruthenium sulfide **catalyst**

IT Hydrogenation **catalysts**

(ruthenium-metal disulfide solid solns., for biphenyl, activity of)

IT Desulfurization **catalysts**

(reductive, ruthenium-metal disulfide solid solns., for thiophene, activity of)

IT **110831-66-8**, Nickel ruthenium sulfide (Ni0.8Ru0.2S2)

110831-67-9, Nickel ruthenium sulfide (Ni0.6Ru0.4S2)

127673-39-6, Iron ruthenium sulfide (Fe0.5Ru0.5S2)

127673-63-6, Iron ruthenium sulfide (Fe0.8Ru0.2S2)

127673-64-7, Cobalt ruthenium sulfide (Co0.6Ru0.4S2)

127673-65-8, Cobalt ruthenium sulfide (Co0.8Ru0.2S2)

127689-83-2, Cobalt ruthenium sulfide (Co0.3Ru0.7S2)

(**catalysts**, for hydrogenation of biphenyl and hydrodesulfurization of thiophene, activity of)

IT 110-02-1, Thiophene

(hydrodesulfurization of, **catalysts** for, ruthenium-metal disulfide solid solns. as, activity of)

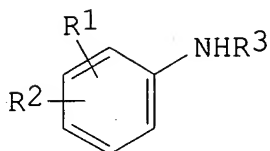
IT 92-52-4, 1,1'-Biphenyl, reactions

(hydrogenation of, **catalysts** for, ruthenium-metal disulfide solid solns. as, activity of)

L49 ANSWER 10 OF 20 HCA COPYRIGHT 2006 ACS on STN

107:154065 Preparation of N-alkylaniline derivatives as intermediates for agrochemicals and pharmaceuticals. Tashiro, Kazuo; Kai, Seiichi; Nakatsuji, Kiyoshi; Tada, Kazuhiro (Sumitomo Chemical Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 62000047 A2 19870106 Showa, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1985-135719 19850620.

GI



I

AB N-Alkylaniline derivs. I (R1, R2 = H, halo, alkyl, alkoxy, OH, SO3H; R1R2 = benzo; R3 = C1-3 alkyl), useful as intermediates for agrochems. and pharmaceuticals (no data), are prepd. PhNH2 was autoclaved with H and HCHO in cyclohexane over Pt-C and HCHO was added slowly to the mixt. at 40° and 40 kg/cm2 H to give 93.3% PhNHMe.

IT **7440-18-8**, Ruthenium, uses and miscellaneous

7440-48-4, Cobalt, uses and miscellaneous **12653-56-4**

, Cobalt sulfide **37245-92-4**, Ruthenium sulfide

(**catalyst**, for reductive alkylation of arom. amines with aldehydes)

RN 7440-18-8 HCA

CN Ruthenium (8CI, 9CI) (CA INDEX NAME)

Ru

RN 7440-48-4 HCA

CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

RN 12653-56-4 HCA

CN Cobalt sulfide (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 37245-92-4 HCA

CN Ruthenium sulfide (7CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
S	x	7704-34-9
Ru	x	7440-18-8

IC ICM C07C087-62

ICS C07C085-00; C07C087-66; C07C091-42; C07C093-14

ICA B01J023-40; B01J027-045

CC 25-4 (Benzene, Its Derivatives, and Condensed Benzenoid Compounds)
Section cross-reference(s): 1, 5

IT 7440-02-0, Nickel, uses and miscellaneous 7440-05-3, Palladium,
uses and miscellaneous 7440-06-4, Platinum, uses and miscellaneous
7440-16-6, Rhodium, uses and miscellaneous **7440-18-8**,
Ruthenium, uses and miscellaneous **7440-48-4**, Cobalt, uses
and miscellaneous 11113-75-0, Nickel sulfide 12627-62-2,
Platinum sulfide 12648-43-0, Palladium sulfide **12653-56-4**
, Cobalt sulfide 37245-91-3, Rhodium sulfide **37245-92-4**,
Ruthenium sulfide
(**catalyst**, for reductive alkylation of arom. amines
with aldehydes)

L49 ANSWER 11 OF 20 HCA COPYRIGHT 2006 ACS on STN

107:142011 Microcalorimetric study of the adsorption of hydrogen on
transition metal sulfides. Melis, Rossana; Boutarfa, Naima;
Gravelle-Rumeau-Maillot, Monique; Lacroix, Michel; Vrinat, Michel;
Breysse, Michele; Gravelle, Pierre C. (Inst. Rech. Catal., Univ.
Claude Bernard Lyon I, Villeurbanne, 69626, Fr.). Journees de
Calorimetrie, d'Analyse Thermique et de Thermodynamique Chimique,
17, 104-9 (French) 1986. CODEN: JCTCEG.

AB Microcalorimetric data for H adsorption on MoS₂, WS₂, RuS₂, or Co₉S₈
are compared to data for **H₂S** adsorption and to exptl.
catalytic activities for biphenyl hydrogenation. Hydrogen reacts in
2 ways with MoS₂: (1) rapid exothermic, without **H₂S**
desorption; (2) more slowly with **H₂S** desorption.

IT **12017-76-4**, Cobalt sulfide (Co₉S₈) **12166-20-0**,
Ruthenium disulfide

(adsorption on, of hydrogen)

RN 12017-76-4 HCA

CN Cobalt sulfide (Co9S8) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
S	8	7704-34-9
Co	9	7440-48-4

RN 12166-20-0 HCA

CN Ruthenium sulfide (RuS2) (6CI, 7CI, 9CI) (CA INDEX NAME)



CC 66-3 (Surface Chemistry and Colloids)

Section cross-reference(s): 67

IT 1317-33-5, Molybdenum disulfide, properties **12017-76-4**,
Cobalt sulfide (Co9S8) 12138-09-9, Tungsten disulfide
12166-20-0, Ruthenium disulfide
(adsorption on, of hydrogen)

L49 ANSWER 12 OF 20 HCA COPYRIGHT 2006 ACS on STN

106:60198 Preparation and properties of the systems cobalt rhodium
sulfide (Co1-xRhXS2), cobalt ruthenium sulfide (Co1-xRuXS2), and
rhodium ruthenium sulfide (Rh1-xRuXS2). Passaretti, J. D.;
Chianelli, R. R.; Wold, A.; Dwight, K.; Covino, J. (Exxon Res. and
Eng. Co., Annandale, NJ, 08801, USA). Journal of Solid State
Chemistry, 64(3), 365-71 (English) 1986. CODEN: JSSCBI. ISSN:
0022-4596.

AB Members of the systems Co1-xRhXS2 ($0 \leq x \leq 0.6$) were
prepd. and their crystallog. and magnetic properties studied. The
obsd. ferromagnetic moments for compns. where $x \leq 0.2$
indicate a ferromagnetic alignment between Co(3d7) and Rh(4d7)
electrons. This is the 1st observation of localized behavior of 4d
electrons in the pyrite structure. Members of the systems
Co1-xRuXS2 ($0 \leq x \leq 1$) and Rh1-xRuXS2 ($0.5 \leq x$
 ≤ 1) were also prepd. and their crystallog. and magnetic
properties studied. From comparison with the Co1-xRhXS2 system, it
appears that the 4d electrons of Rh(4d7) are localized in the
presence of Co(3d7) but are delocalized in the presence of Ru(4d6).
The magnetic susceptibility of the Co1-xRuXS2 system is sensitive to
the homogeneity of the products and indicates that Ru(4d6) behaves
as a diamagnetic ion.

IT **12013-10-4DP**, solid solns. with rhodium disulfide and with
ruthenium disulfide **12166-20-0DP**, solid solns. with cobalt
disulfide and with rhodium disulfide

(prepn. and crystallog. and magnetic properties of)

RN 12013-10-4 HCA

CN Cobalt sulfide (CoS₂) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)



RN 12166-20-0 HCA

CN Ruthenium sulfide (RuS₂) (6CI, 7CI, 9CI) (CA INDEX NAME)



IT **7783-06-4, Hydrogen sulfide**, reactions

(reactions of, with pentamminechlorocobalt(2+) chloride and ammonium hexachlororhodate or ammonium hexachlororuthenate or ammonium hexachlororhodate and ammonium hexachlororuthenate)

RN 7783-06-4 HCA

CN Hydrogen sulfide (H₂S) (8CI, 9CI) (CA INDEX NAME)

H₂S

CC 78-6 (Inorganic Chemicals and Reactions)

Section cross-reference(s): 75, 77

IT **12013-10-4DP**, solid solns. with rhodium disulfide and with ruthenium disulfide 12038-73-2DP, solid solns. with cobalt disulfide and with ruthenium disulfide **12166-20-0DP**, solid solns. with cobalt disulfide and with rhodium disulfide (prepn. and crystallog. and magnetic properties of)

IT 13859-51-3

(reactions of, with **hydrogen sulfide** and ammonium hexachlororhodate or ammonium hexachlororuthenate)

IT 18746-63-9, Diammonium hexachlororuthenate(2-)

(reactions of, with **hydrogen sulfide** and ammonium hexachlororhodate or pentaamminechlorocobalt(2+) dichloride)

IT 15336-18-2

(reactions of, with **hydrogen sulfide** and pentaamminechlorocobalt(2+) dichloride or diammonium hexachlororuthenate)

IT **7783-06-4, Hydrogen sulfide**, reactions

(reactions of, with pentamminechlorocobalt(2+) chloride and ammonium hexachlororhodate or ammonium hexachlororuthenate or ammonium hexachlororhodate and ammonium hexachlororuthenate)

L49 ANSWER 13 OF 20 HCA COPYRIGHT 2006 ACS on STN

105:144872 The preparation and magnetic properties of the system cobalt

ruthenium sulfide (Co1-xRuS2) and the electrochemical hydrogenation of benzene by solvated electrons in HMPA-ethanol solutions using colloidal ruthenium particles. Foise, Jonathan Walter (Brown Univ., Providence, RI, USA). 114 pp. Avail. Univ. Microfilms Int., Order No. DA8519835 From: Diss. Abstr. Int. B 1986, 46(7), 2300 (English) 1985.

AB Unavailable

IT **7440-18-8**, reactions
(colloidal particles of, electrochem. hydrogenation of benzene in presence of)

RN 7440-18-8 HCA

CN Ruthenium (8CI, 9CI) (CA INDEX NAME)

Ru

IT **12013-10-4DP**, solid solns. with ruthenium disulfide
12166-20-0DP, solid solns. with cobalt disulfide
(prepn., crystal structure and magnetic properties of)

RN 12013-10-4 HCA

CN Cobalt sulfide (CoS2) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)

S=Co=S

RN 12166-20-0 HCA

CN Ruthenium sulfide (RuS2) (6CI, 7CI, 9CI) (CA INDEX NAME)

S=Ru=S

CC 78-6 (Inorganic Chemicals and Reactions)
Section cross-reference(s): 25

IT Hydrogenation **catalysts**
(electrochem., ruthenium colloid as, for benzene)

IT **7440-18-8**, reactions
(colloidal particles of, electrochem. hydrogenation of benzene in presence of)

IT **12013-10-4DP**, solid solns. with ruthenium disulfide
12166-20-0DP, solid solns. with cobalt disulfide
(prepn., crystal structure and magnetic properties of)

L49 ANSWER 14 OF 20 HCA COPYRIGHT 2006 ACS on STN

101:37838 **Catalysis** by transition metal sulfides: the relation between calculated electronic trends and HDS activity. Harris, Suzanne; Chianelli, R. R. (Exxon Res. and Eng. Co., Annandale, NJ, 08801, USA). Journal of Catalysis, 86(2), 400-12 (English) 1984. CODEN: JCTLA5. ISSN: 0021-9517.

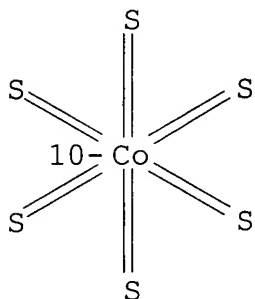
AB SCF-X α calcs. of the electronic structure of cluster models of the first and second row transition metal sulfides identified electronic factors, related to their hydrosulfurization **catalytic** activity, which were combined to form an activity parameter for each sulfide. A model for the binding of mol. thiophene to the **catalyst** surface was consistent both with the relation between bulk electronic structure and sulfide **catalytic** activity, and with the ligand properties of thiophene in transition metal complexes.

IT **82371-86-6 82371-91-3**

(HOMO of, correlation with hydrosulfurization **catalytic** activity)

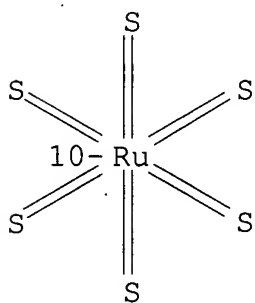
RN 82371-86-6 HCA

CN Cobaltate(10-), hexathioxo-, (OC-6-11)- (9CI) (CA INDEX NAME)



RN 82371-91-3 HCA

CN Ruthenate(10-), hexathioxo-, (OC-6-11)- (9CI) (CA INDEX NAME)



IT **7440-18-8D**, sulfide cluster, uses and miscellaneous

7440-48-4D, sulfide cluster, uses and miscellaneous

(**catalysts**, for hydrosulfurization of thiophenes, MO study of)

RN 7440-18-8 HCA

CN Ruthenium (8CI, 9CI) (CA INDEX NAME)

Ru

RN 7440-48-4 HCA
 CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT **12017-76-4 12166-20-0**
 (hydrodesulfurization **catalytic** activity of, calcd.
 electronic parameters for)
 RN 12017-76-4 HCA
 CN Cobalt sulfide (Co9S8) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
S	8	7704-34-9
Co	9	7440-48-4

RN 12166-20-0 HCA
 CN Ruthenium sulfide (RuS2) (6CI, 7CI, 9CI) (CA INDEX NAME)

S==Ru==S

CC 22-2 (Physical Organic Chemistry)
 Section cross-reference(s): 29, 65, 67
 ST MO hydrodesulfurization **catalytic** activity; thiophene
 adsorption transition sulfide
 IT Transition metal sulfides
 (**catalysts**, for hydrodesulfurization of thiophenes, MO
 study of)
 IT Electron configuration
 (in transition metal sulfide clusters, hydrodesulfurization
catalytic activity in relation to)
 IT Cluster compounds
 (transition metal sulfides, as hydrodesulfurization
catalysts, MO study of)
 IT Desulfurization **catalysts**
 (hydro-, transition metal sulfides, for thiophenes, MO study of)
 IT 12039-15-5 64521-81-9 76468-66-1 82371-82-2 82371-83-3
 82371-84-4 82371-85-5 **82371-86-6** 82371-87-7
 82371-88-8 82371-89-9 82371-90-2 **82371-91-3**
 82371-92-4 82378-44-7
 (HOMO of, correlation with hydrodesulfurization **catalytic**

- activity)
- IT 7440-05-3D, sulfide cluster, uses and miscellaneous
(**catalyst**, for hydrodesulfurization of thiophenes, MO
calcs. in relation to activity of)
- IT 7439-88-5D, sulfide cluster, uses and miscellaneous 7439-89-6D,
sulfide cluster, uses and miscellaneous 7439-96-5D, sulfide
cluster, uses and miscellaneous 7439-98-7D, sulfide cluster, uses
and miscellaneous 7440-02-0D, sulfide cluster, uses and
miscellaneous 7440-03-1D, sulfide cluster, uses and miscellaneous
7440-04-2D, sulfide cluster, uses and miscellaneous 7440-05-3D,
sulfide cluster, uses and miscellaneous 7440-06-4D, sulfide
cluster, uses and miscellaneous 7440-15-5D, sulfide cluster, uses
and miscellaneous 7440-16-6D, sulfide cluster, uses and
miscellaneous **7440-18-8D**, sulfide cluster, uses and
miscellaneous 7440-25-7D, sulfide cluster, uses and miscellaneous
7440-26-8D, sulfide cluster, uses and miscellaneous 7440-31-5D,
sulfide cluster, uses and miscellaneous 7440-32-6D, sulfide
cluster, uses and miscellaneous 7440-33-7D, sulfide cluster, uses
and miscellaneous 7440-47-3D, sulfide cluster, uses and
miscellaneous **7440-48-4D**, sulfide cluster, uses and
miscellaneous 7440-57-5D, sulfide cluster, uses and miscellaneous
7440-62-2D, sulfide cluster, uses and miscellaneous 7440-67-7D,
sulfide cluster, uses and miscellaneous
(**catalysts**, for hydrodesulfurization of thiophenes, MO
study of)
- IT 1315-01-1 1317-33-5, uses and miscellaneous 1317-37-9
12017-76-4 12018-22-3 12030-51-2 12035-72-2
12038-20-9 12038-63-0 12067-06-0 12125-22-3 12136-97-9
12137-61-0 12138-09-9 12143-72-5 **12166-20-0**
12166-28-8D, vanadium-excess 18820-29-6 34312-50-0
(hydrodesulfurization **catalytic** activity of, calcd.
electronic parameters for)
- L49 ANSWER 15 OF 20 HCA COPYRIGHT 2006 ACS on STN
- 98:145101 Corrosion-resistant solid lubricant coating. (Laboratoire
Suisse de Recherches Horlogeres, Switz.). Eur. Pat. Appl. EP 69701
A1 19830112, 13 pp. DESIGNATED STATES: R: AT, BE, CH, DE, FR, GB,
IT, LI, NL, SE. (French). CODEN: EPXXDW. APPLICATION: EP
1982-810275 19820628. PRIORITY: CH 1981-4311 19810630; CH 1981-6509
19811012.
- AB The title coatings, resistant to moist, oxidizing atms., are prepd.
by sulfiding the surface of metals in **H2S** plasmas and
sputtering the sulfide surface simultaneously with solid lubricants,
e.g., MoS₂, and polymers, esp., PTFE [9002-84-0]. Thus, steel was
cleaned in a cathodic sputtering chamber in Ar at 800 V, 3.3 W/cm²,
and 0.01 mbar, sputtered with Ni at 100 V, 5.4 W/cm², and 0.01 mbar,
treated with 0.001 mbar **H2S** under the same conditions, and
sputtered with MoS₂-PTFE. In wear testing (steel balls, 5 N, 0.6

m/min, 52% relative humidity) the coating had a lifetime of 8100 revolutions and time to failure 400 min, compared with 4800 and 275, resp., without the Ni sulfide layer, and 510 and 106, resp., for a MoS₂ layer.

IT **12653-56-4 37245-92-4**

(coatings, lubricating and corrosion-resistant, sputtering of)

RN 12653-56-4 HCA

CN Cobalt sulfide (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 37245-92-4 HCA

CN Ruthenium sulfide (7CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
S	x	7704-34-9
Ru	x	7440-18-8

IC C23C015-00

CC 42-2 (Coatings, Inks, and Related Products)

IT 1317-33-5, uses and miscellaneous 9002-84-0 11113-75-0
 11115-78-9 12143-72-5 12612-50-9 12623-97-1 12627-71-3
 12648-43-0 **12653-56-4** 12673-92-6 18855-94-2
 37245-91-3 **37245-92-4** 39290-91-0 50927-81-6

(coatings, lubricating and corrosion-resistant, sputtering of)

L49 ANSWER 16 OF 20 HCA COPYRIGHT 2006 ACS on STN

97:38660 Conversion of mononitro aromatic compounds to amino compounds by **hydrogen sulfide**. Ratcliffe, Charles T.; Soled, Stuart L.; Signorelli, Anthony J.; Mador, Irving L. (Allied Corp., USA). U.S. US 4326081 A 19820420, 4 pp. (English). CODEN: USXXAM. APPLICATION: US 1981-237326 19810223.

AB Nitrobenzenes were reduced to the corresponding amines with **H₂S** in the presence of TiO₂ **catalyst** at 200-400° and atm. pressure. The **catalyst** was optionally modified with a transition metal sulfide. Thus, an 8:1 mixt. of **H₂S** and PhNO₂ was passed over TiO₂ at 300° (time on stream 30 min) to give PhNH₂ 97.9 and PhNO₂ 2.1 mol %.

IT **1317-42-6D**, nonstoichiometric **7440-48-4**, uses and miscellaneous

(**catalysts** contg. titanium dioxide and, for redn. of nitrobenzene with **hydrogen sulfide**)

RN 1317-42-6 HCA

CN Cobalt sulfide (CoS) (8CI, 9CI) (CA INDEX NAME)

Co=S

RN 7440-48-4 HCA
CN Cobalt (8CI, 9CI) (CA INDEX NAME)

Co

IT **12166-20-0D**, nonstoichiometric
(**catalysts** contg. titanium dioxide and, for redn. of
nitrobenzene with **hydrogen sulfide**)

RN 12166-20-0 HCA
CN Ruthenium sulfide (RuS₂) (6CI, 7CI, 9CI) (CA INDEX NAME)

S—Ru—S

IT **7783-06-4**, reactions
(redn. by, of mononitro arom. compds., titanium dioxide
catalysts for)

RN 7783-06-4 HCA
CN Hydrogen sulfide (H₂S) (8CI, 9CI) (CA INDEX NAME)

H₂S

IC C07C085-11
INCL 564416000
CC 25-4 (Benzene, Its Derivatives, and Condensed Benzenoid Compounds)
ST nitro compd redn **hydrogen sulfide**; titanium
dioxide redn **catalyst**; nitrobenzene redn **catalyst**
; aniline

IT Reduction **catalysts**
(titanium dioxide, for arom. nitro compds. with **hydrogen**
sulfide)

IT Nitro compounds
(aryl, redn. of, with **hydrogen sulfide**,
titanium dioxide **catalyst** for)

IT 13463-67-7, uses and miscellaneous
(**catalyst**, for redn. of mononitro arom. compds. with
hydrogen sulfide)

IT 1314-62-1, uses and miscellaneous 1317-37-9D, nonstoichiometric
1317-42-6D, nonstoichiometric **7440-48-4**, uses and
miscellaneous
(**catalysts** contg. titanium dioxide and, for redn. of
nitrobenzene with **hydrogen sulfide**)

IT 12030-51-2D, nonstoichiometric 12038-20-9D, nonstoichiometric
12125-22-3D, nonstoichiometric 12137-61-0D, nonstoichiometric
12137-99-4D, nonstoichiometric **12166-20-0D**,
nonstoichiometric 16812-54-7D, nonstoichiometric

- (**catalysts** contg. titanium dioxide and, for redn. of nitrobenzene with **hydrogen sulfide**)
- IT 62-53-3P, preparation
(prepn. of, by redn. of nitrobenzene with **hydrogen sulfide**, titanium dioxide **catalyst** for)
- IT 95-51-2P 591-19-5P
(prepn. of, by titanium oxide **catalyzed hydrogen sulfide** redn. of nitrobenzene deriv.)
- IT 7783-06-4, reactions
(redn. by, of mononitro arom. compds., titanium dioxide **catalysts** for)
- IT 88-73-3 88-75-5 98-95-3, reactions 99-99-0 100-00-5
100-02-7, reactions 121-73-3 585-79-5 3970-40-9
(redn. of, with **hydrogen sulfide**, titanium dioxide **catalyst** for)

L49 ANSWER 17 OF 20 HCA COPYRIGHT 2006 ACS on STN

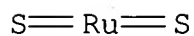
95:72264 Preparation and properties of poorly crystallized cobalt disulfide and ruthenium disulfide. Passaretti, J. D.; Dwight, K.; Wold, A.; Croft, W. J.; Chianelli, R. R. (Dep. Chem., Brown Univ., Providence, RI, 02912, USA). Inorganic Chemistry, 20(8), 2631-4 (English) 1981. CODEN: INOCAJ. ISSN: 0020-1669.

AB Amorphous or poorly crystd. samples of RuS₂ and CoS₂ were made by sulfurizing (NH₄)₂RuCl₆ and Co(NH₃)₆Cl₂ at low temps. with **H₂S**. The amorphous products were annealed under various conditions, and the resulting degree of crystallinity was detd. For RuS₂, the av. crystallite sizes ranged from 26 Å for the poorly crystd. material to >2000 Å for the well crystd. material. CoS₂ av. crystallite sizes ranged from 130 Å to >2000 Å. The stoichiometry, appearance of the cryst. pyrite phases, cell parameters, and magnetic properties were studied as a function of annealing temp.

IT 12166-20-0
(poorly crystd.)

RN 12166-20-0 HCA

CN Ruthenium sulfide (RuS₂) (6CI, 7CI, 9CI) (CA INDEX NAME)



IT 12013-10-4P
(prepn. and properties of poorly crystd.)

RN 12013-10-4 HCA

CN Cobalt sulfide (CoS₂) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)



IT 7783-06-4, reactions
(reactions of, with diammonium hexachlororuthenate and with
hexaamminecobalt dichloride)

RN 7783-06-4 HCA

CN Hydrogen sulfide (H₂S) (8CI, 9CI) (CA INDEX NAME)

H₂S

CC 78-5 (Inorganic Chemicals and Reactions)

Section cross-reference(s): 75

IT 12166-20-0

(poorly crystd.)

IT 12013-10-4P

(prepn. and properties of poorly crystd.)

IT 13874-13-0 18746-63-9

(reaction of, with **hydrogen sulfide**)

IT 7783-06-4, reactions

(reactions of, with diammonium hexachlororuthenate and with
hexaamminecobalt dichloride)

L49 ANSWER 18 OF 20 HCA COPYRIGHT 2006 ACS on STN

91:210994 Selective catalytic hydrogenation of aromatic nitro groups in the presence of acetylenes. Synthesis of (3-aminophenyl)acetylene via hydrogenation of (3-nitrophenyl)acetylene over cobalt polysulfide and ruthenium sulfide catalysts. Onopchenko, Anatoli; Sabourin, Edward T.; Selwitz, Charles M. (Chem. Miner. Div., Gulf Res. Dev. Co., Pittsburgh, PA, 15230, USA). Journal of Organic Chemistry, 44(21), 3671-4 (English) 1979. CODEN: JOCEAH. ISSN: 0022-3263. OTHER SOURCES: CASREACT 91:210994.

AB CoS_x (av. x = 3) and RuS₂ catalyzed the selective hydrogenation of arom. nitro groups in the presence of acetylenes. Thus, 3-O₂NC₆H₄C.tplbond.CH (I), 3-O₂NC₆H₄C.tplbond.CCMe₂OH and 4-O₂NC₆H₄CO₂CRR1C.tplbond.CH (R = R1 = H; R = Me, R1 = Pr) were converted to the corresponding amines in 75-85% yield. Typical reactions were carried out in Me₂CHOH at .apprx.100° and H pressures at 25-70 atm. With the activated and unprotected I, hydration of the acetylene bond competed with the nitro group hydrogenation. Hydrogenation involves a chem. redn. by **H₂S**, which is catalytically generated under the reaction conditions. Highly reactive substrates interfere with the regenerative cycle of the catalyst by removing S species from the system, which leads to low turnover frequency. Cobalt maintains the 2+ valency throughout its regenerative cycle, while ruthenium changes from the 4+ to the 2+ valency state.

IT 12166-20-0 12653-56-4

(catalysts, for selective hydrogenation of arom. nitro groups in presence of acetylenes)

RN 12166-20-0 HCA
 CN Ruthenium sulfide (RuS2) (6CI, 7CI, 9CI) (CA INDEX NAME)



RN 12653-56-4 HCA
 CN Cobalt sulfide (9CI) (CA INDEX NAME)
 *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
 CC 25-4 (Noncondensed Aromatic Compounds)
 IT 12166-20-0 12653-56-4

(catalysts, for selective hydrogenation of arom. nitro groups in presence of acetylenes)

L49 ANSWER 19 OF 20 HCA COPYRIGHT 2006 ACS on STN
 83:74924 **Catalyst** electrode specific for peroxide. Updike, Stuart J.; Shults, Mark C.; Kosovich, Judy K.; Treichel, Isabel; Treichel, Paul M. (Dep. Med., Univ. Wisconsin, Madison, WI, USA). Analytical Chemistry, 47(8), 1457-9 (English) 1975. CODEN: ANCHAM. ISSN: 0003-2700.

AB A H2O2-sensitive inorg. **catalyst** electrode was described that was made by covering an O electrode with a cellulosic membrane contg. noble and transition metal oxides and sulfides that **catalyzed** the breakdown of H2O2 to O. The electrode was similar in principle to an enzyme electrode but had the added stability gained by using an inorg. **catalyst** rather than an enzyme such as catalase. Of numerous compds. tested, only compds. of Mn, Co, and Ru showed high **catalytic** activity.

IT 1308-04-9 12060-06-9 12067-11-7
 12653-56-4

(electrode contg., for peroxide detn.)

RN 1308-04-9 HCA
 CN Cobalt oxide (Co2O3) (8CI, 9CI) (CA INDEX NAME)
 *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
 RN 12060-06-9 HCA
 CN Ruthenium oxide (Ru2O3) (7CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component
		Registry Number
=====		
O	3	17778-80-2
Ru	2	7440-18-8

RN 12067-11-7 HCA
 CN Ruthenium sulfide (Ru2S3) (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component
		Registry Number


```
=====+=====+=====
S          |          3          |          7704-34-9
Ru         |          2          |          7440-18-8
```

RN 12653-56-4 HCA
CN Cobalt sulfide (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
CC 9-3 (Biochemical Methods)
ST hydrogen peroxide detn **catalyst** electrode
IT Electrodes
 (peroxide-sensitive, inorg. **catalyst** in)
IT 7722-84-1, analysis
 (detn. of, inorg. **catalyst** electrode for)
IT **1308-04-9** 1313-13-9, uses and miscellaneous
 12060-06-9 12067-11-7 12653-56-4
 (electrode contg., for peroxide detn.)

L49 ANSWER 20 OF 20 HCA COPYRIGHT 2006 ACS on STN
32:10960 Original Reference No. 32:1559c-f Data on theoretical
metallurgy. VII The thermodynamic properties of sulfur and its
inorganic compounds. Kelley, K. K. Bulletin - United States,
Bureau of Mines, No. 406, 154 pp. (Unavailable) 1937.